

Implementation of the United States/Russian HEU Agreement: Current Status and Prospects



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HEU Transparency Implementation Program



- **A highly successful nonproliferation program:**
 - Assures the permanent removal of 500 metric tons (MT) of weapons-usable highly enriched uranium (HEU) from use in Russian nuclear weapons.
 - Monitors the processing and down blending of the HEU into low enriched uranium (LEU) for shipment to the United States for use as nuclear fuel in commercial power reactors.
 - Through July 2003, over 190 MT HEU (equivalent to 7,600 nuclear devices) will have been monitored and converted to over 5,600 MT LEU and delivered to the United States Enrichment Corporation (USEC).
- **Since 1995, the accumulation of transparency data and analysis provides quantitative assurance that nonproliferation objectives are being achieved.**
- **On the tenth anniversary of the HEU Purchase Agreement (February 2003), Russia's Ministry for Atomic Energy saluted the successful implementation of the government-to-government program as "an example of the effective realization of bilateral cooperation in real disarmament."**

Highly Enriched Uranium Transparency Implementation Program

- Transparency measures are to assure that:

HEU is from Russian weapons-usable material.



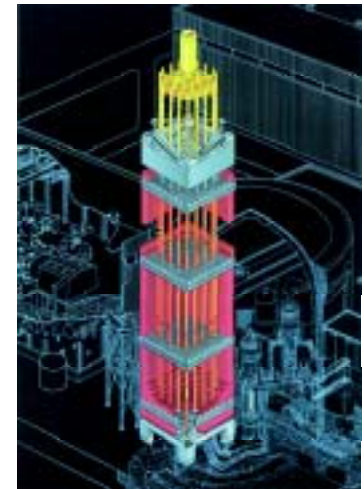
Nuclear weapons display in Russia

*This same HEU is converted
and downblended to LEU.*



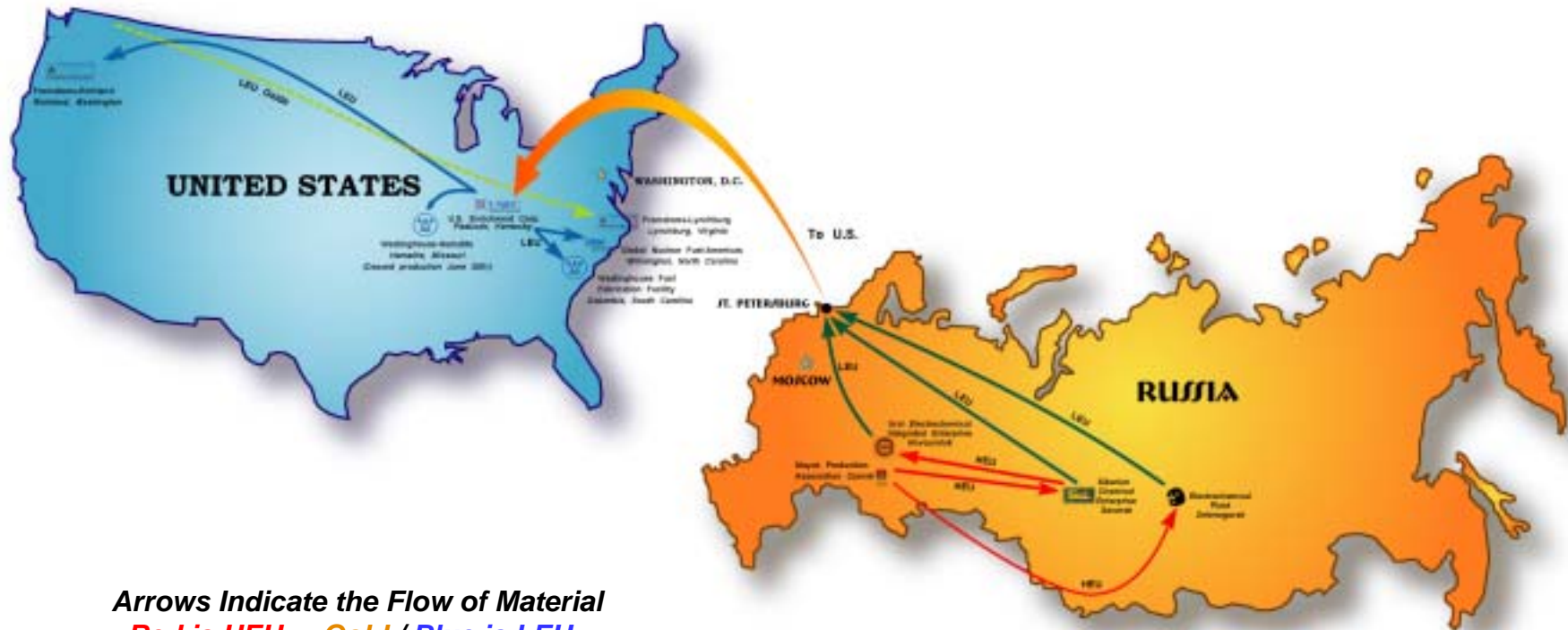
HEU-TIP monitor at Russian facility glove box

*The LEU shipped to the United
States is fabricated into fuel
for commercial nuclear reactors.*



*Artist's Concept of a fuel rod assembly
being installed in a nuclear power
reactor*

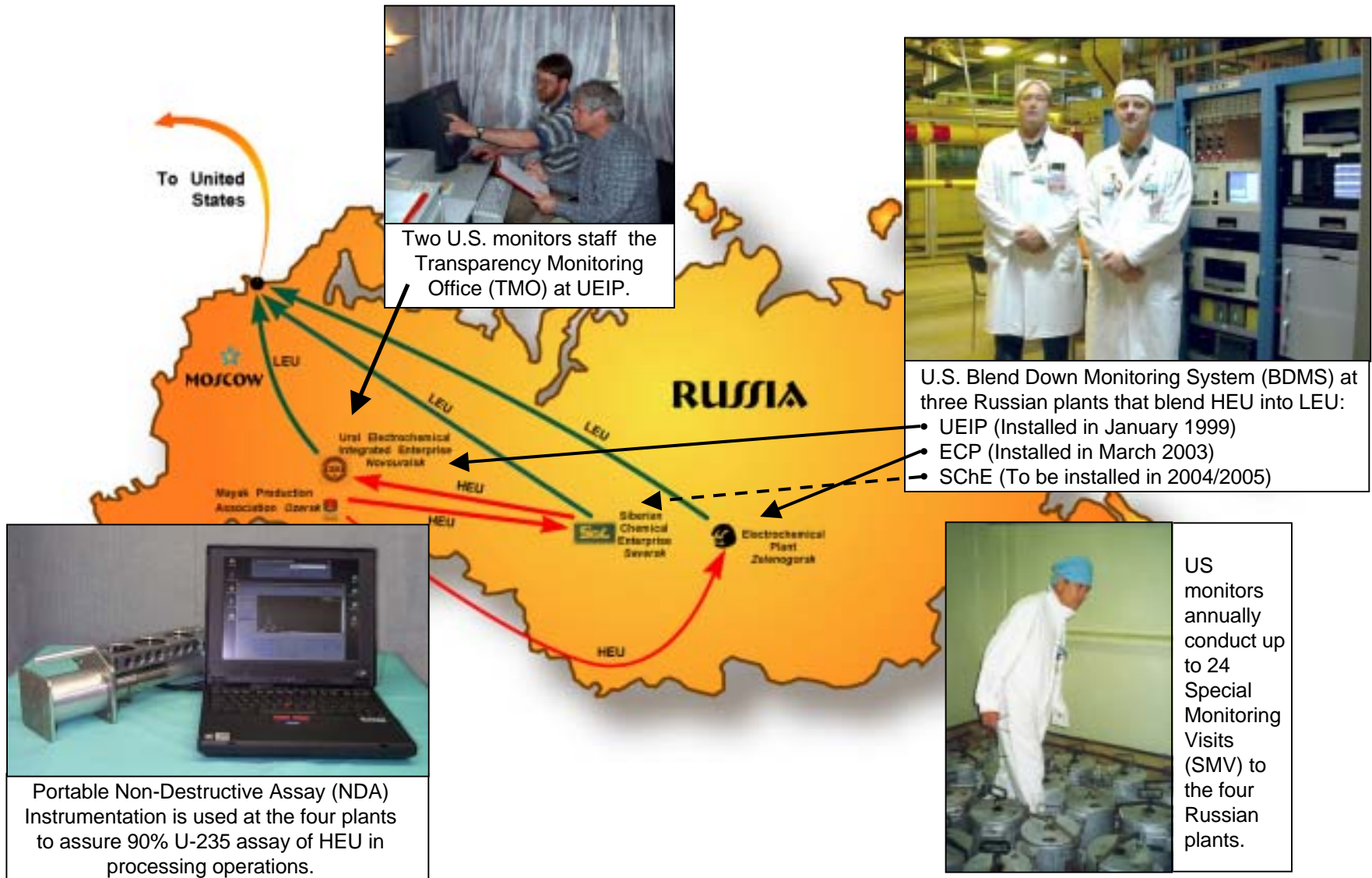
- Full access to four Russian plants fully implemented over the past eight years of monitoring activity.
- Supports US nonproliferation policy initiatives.



Arrows Indicate the Flow of Material

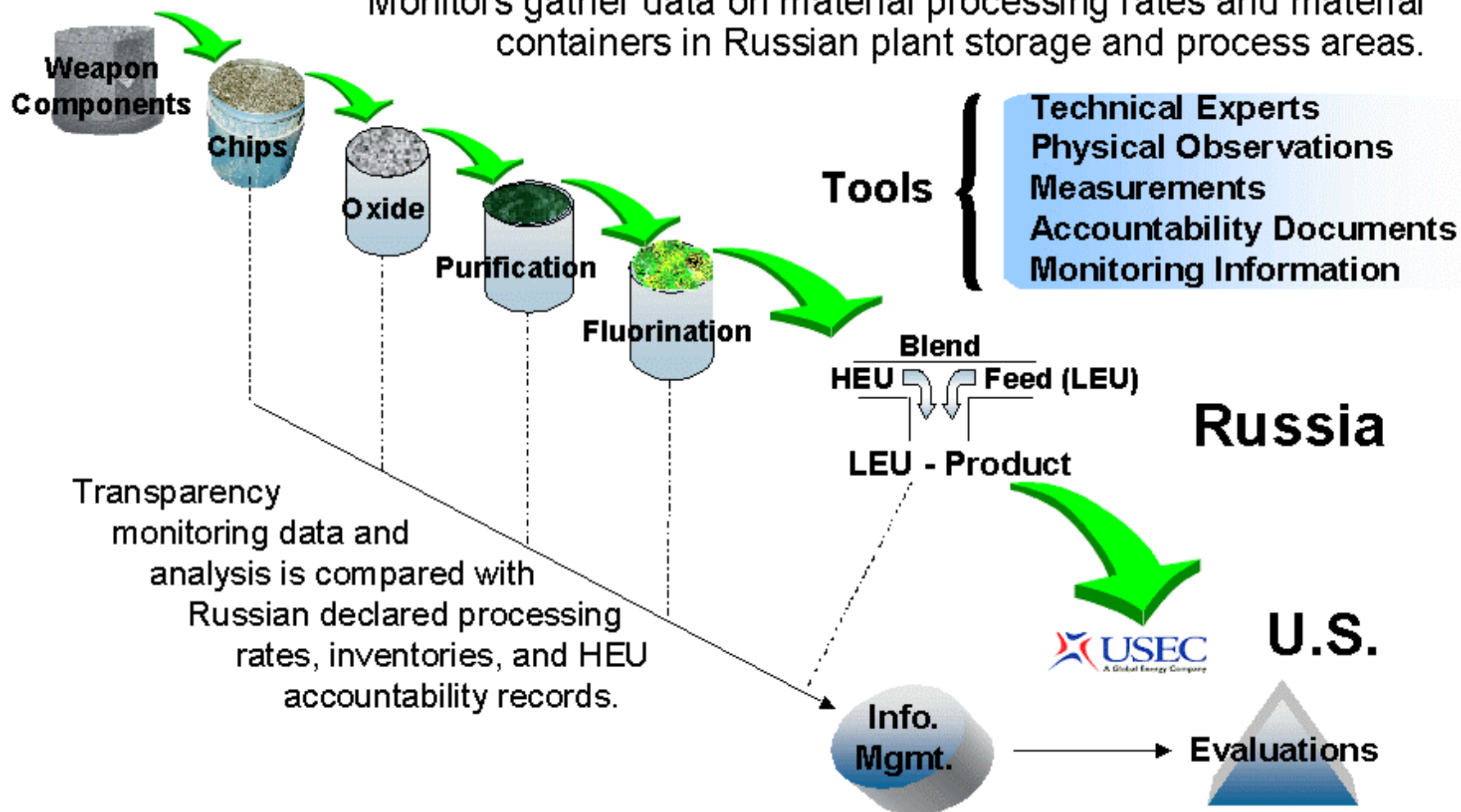
Red is HEU Gold / Blue is LEU

HEU-TIP Monitoring Activities Assure Nonproliferation Objectives are Met

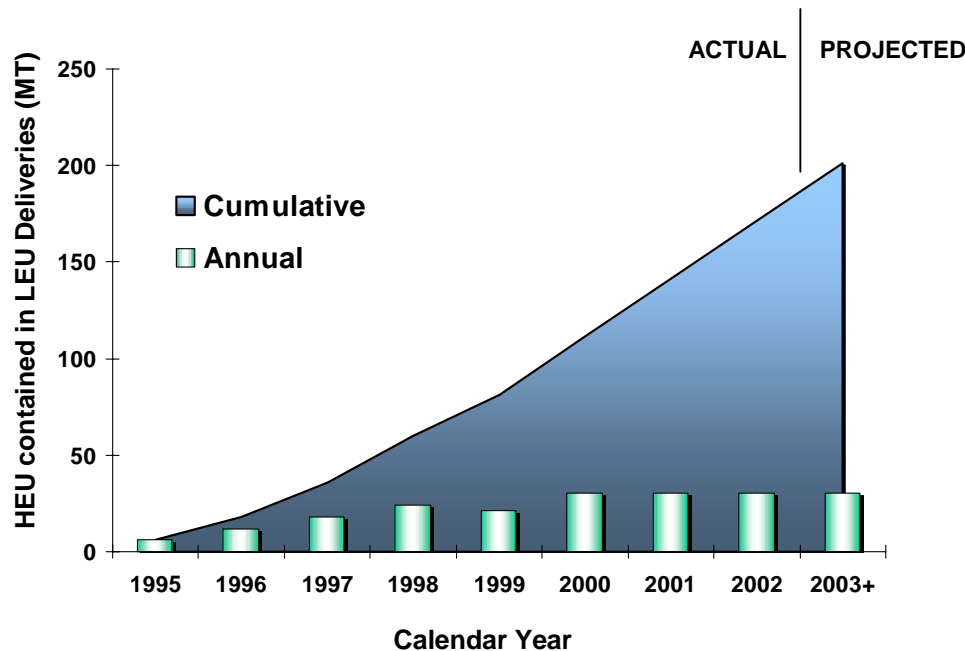


Transparency Process

Monitors gather data on material processing rates and material containers in Russian plant storage and process areas.



Russian HEU Converted & Monitored



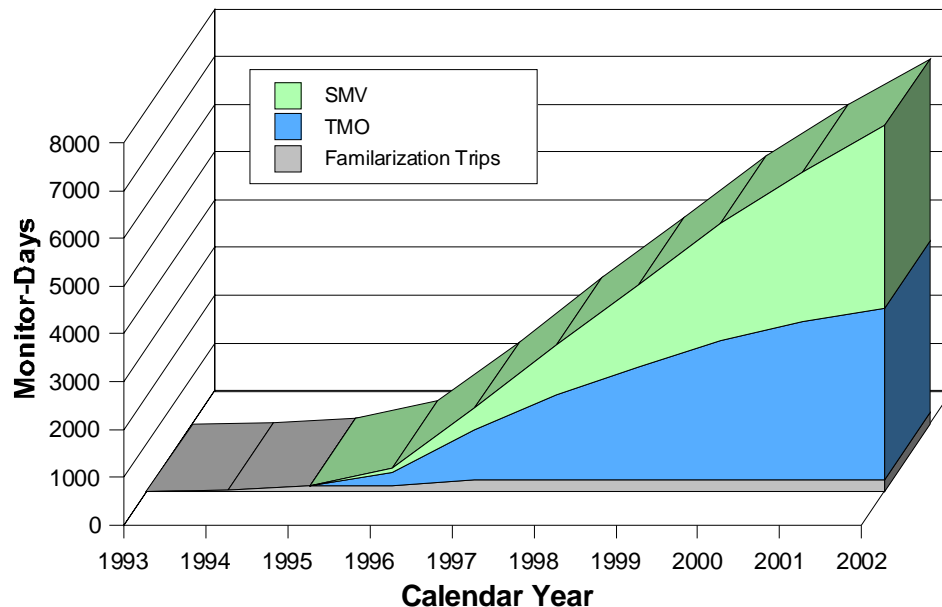
30 MT HEU Annual Projection (2000-2013)

- Through July 2003, HEU-TIP will have monitored the conversion and blending of over 190 MT HEU used to produce the LEU delivered to USEC.
- 190 MT of HEU is equivalent to 7,600 nuclear devices*.
- Russia will have delivered over 5,600 MT LEU containing over 35 million SWU and 57 thousand MT of natural uranium.
- By the end of CY 2002, MINATOM received over \$3.5 billion and over 21,000 MT of natural uranium feed was returned to Russia.
- Conversion of 500 MT HEU into 15,000 MT of LEU should be completed in 2013 under the 20-year contract.
- 500 MT of HEU is roughly equivalent to 20,000 nuclear devices*.

* Per IAEA standard for significant quantity of nuclear material

HEU-TIP Monitoring Trips

Historical HEU-TIP Monitor Days
Cumulative



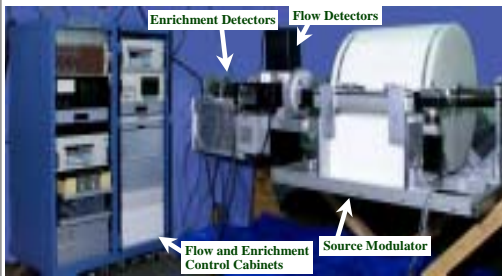
Conducted over 100 SMV trips since 1996

- In CY 2002 there were 20 Special Monitoring Visits (SMV) to four Russian processing plants and 10 monitors assigned to the Transparency Monitoring Office (TMO) at UEIP.
- From 1993 through 2002:
 - 114 TMO monitors (3,589 monitor-days)
 - 114 SMV trips (3,822 monitor-days)
 - 12 Familiarization trips
 - 2 Natural Uranium Inventory trips
- 21 SMV trips are scheduled for CY 2003.
- Maximum coverage allows 24 SMV trips per year and a TMO staffed up to 12 months per year.
- Completed the second inventory verification of natural uranium feed component returned to Russia through 2001.

Blend Down Monitoring System

- System designed in the USA -

Role of the BDMS in the HEU Transparency Implementation Program



- The BDMS significantly increases confidence that HEU is blended into LEU Product by monitoring continuously the following items through the blending operations:

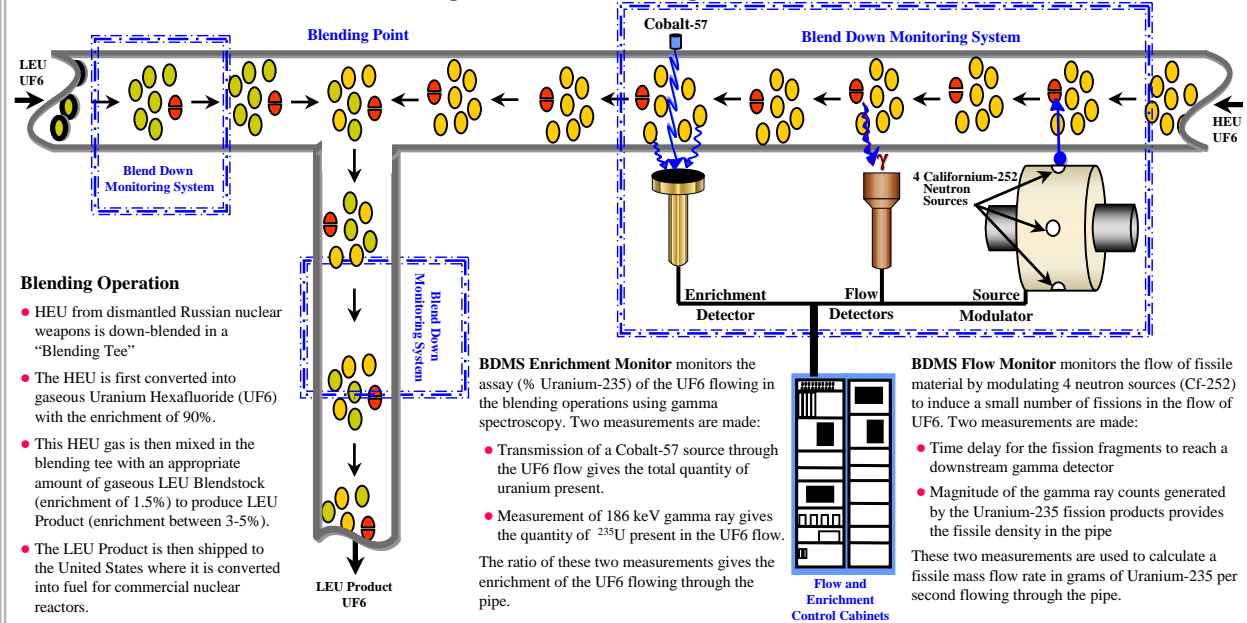
- **Enrichment** assays:

- Uranium Hexafluoride (UF₆) in the HEU line
- LEU Blendstock Line
- LEU Product Line

- **Mass flow** rate of fissile material

- **Tracing** the flow of HEU

Monitoring of HEU Down-Blending in Russian Facilities



Russian Delegations Received BDMS Equipment Training Twice

- **Training of personnel in Oak Ridge, Tennessee, included:**

- The Ministry of the Russian Federation for Atomic Energy (Minatom)
- Russian Federal Nuclear Radiation and Safety Authority (GAN)
- UEIP (installed in January 1999)
- ECP (installed in February 2003)
- SCHE (installation scheduled for 2004/05)



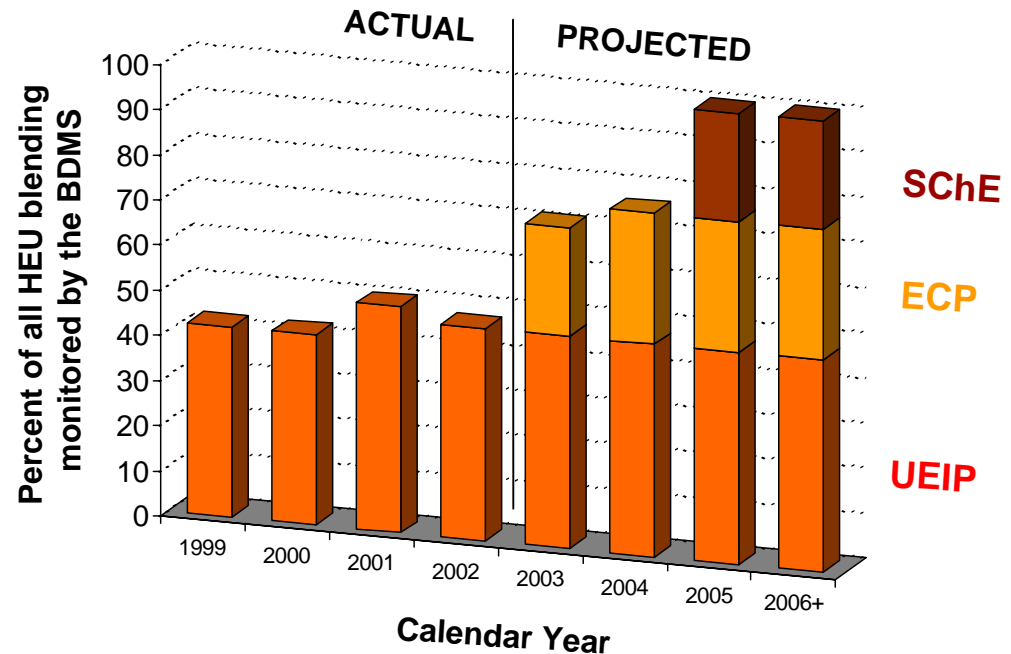
The BDMS is now operating at Two Russian Processing Plants



The BDMS confirms the traceability, flow and enrichment assay of HEU being blended into LEU.

The BDMS will Monitor Blending of HEU at Three Russian Processing Plants

- Two BDMS were installed at **UEIP in January 1999** and certified in August 1999.
- A BDMS was installed at **ECP in February 2003** and certified in March 2003.
- A BDMS is expected to be installed at **SChE in 2004/2005** with operation starting early 2005.
- The BDMS will provide 100 percent monitoring of HEU down blended into LEU once installed at all three plants.



Radioactive sources for the BDMS equipment are being supplied by the Russian Federal Nuclear Center-Institute of Technical Physics (Chelyabinsk-70)

NDA Equipment is used to confirm the presence of HEU

US monitors performed over 3,000 measurements using portable Non-Destructive Assay Equipment to confirm the presence/absence of HEU in containers during 2002.

New updated NDA equipment is now being sent to all four Russian plants. Units will be in place by mid-2004.



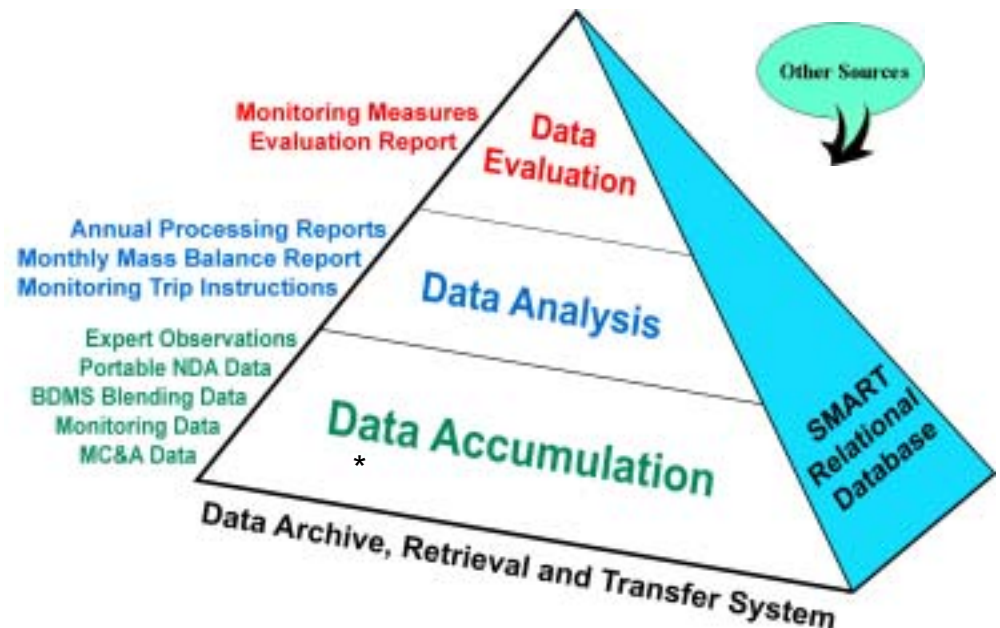
Monitor uses NDA equipment at Russian plant



Replacement NDA equipment

- New portable NDA units retain the same operating principles/procedures.
- Employs the AMPTEK GAMMA-X system.
- Operates on any Windows 95/98/NT/2000/XP platform.
- Sodium Iodide (NaI) based measurement.
- Enhanced reliability and longer battery life.
- More compact and lighter than older units.

- **Embassy exchange of data in CY 2002:**
 - Received from Minatom: Russian facility material control and accountability data which were archived and processed in DARTS*. (~3,500 pages)
 - Sent to Minatom: U.S. facility material control and accountability data to Minatom. (~4,900 pages)
- **Operated a secure computer system between 14 U.S. sites to centralize and manage monitoring activities and data.**



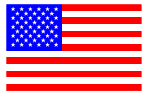
Russian Monitoring in the United States



Paducah Gaseous Diffusion Plant receives the LEU shipped from Russia.



Last Russian Monitoring visit to the United States was in October 2000. **Next visit is scheduled in September/October 2003.**



Five U.S. Fuel Fabricators subject to monitoring by Russian Federation:

- Global Nuclear Fuel - Americas, Wilmington, NC
- Framatome-Lynchburg, Lynchburg, VA
- Framatome-Richland, Richland, WA
- Westinghouse Nuclear Fuel, Columbia, SC
- Westinghouse-Hematite*, Hematite, MO

* Ceased fabrication operations in 2001.

Three Russian monitors (left) at Global Nuclear Fuel inspecting cylinders that contain LEU purchased from Russia



Russian monitors inspecting cylinders at Westinghouse Nuclear Fuel

Our Future Efforts

- **Deploy up to 24 SMV trips per year to the four Russian plants.**
- **Maintain a TMO at UEIP.**
- **Install and maintain BDMS at the three Russian blending facilities.**
- **Improve the use and reliability of NDA equipment.**
- **Support Russian Federation monitoring in the United States.**
- **Increase interaction with other DOE programs to better integrate information and improve monitoring.**
- **Conduct annual inventories of the natural uranium feed returned and stored in Russia as per the March 1999 Agreement concerning the transfer of source material.**

In Closing

- **The HEU-TIP is a robust and mature program supported by five DOE operation offices and seven major DOE laboratories.**
- **Cooperation between the United States and the Russian Federation has resulted in unprecedented success of our joint transparency activities to support the nonproliferation objectives of the HEU Purchase Agreement.**
- **Continued cooperation and mutual respect enables us to translate innovation and ideas into practical solutions for meeting global nuclear nonproliferation objectives.**

Annual deliveries of LEU blended from 30 MT of weapons-grade HEU provides up to 50 percent of the annual US nuclear fuel requirement, which accounts for 10 percent of the electricity generated in the United States.